

## Water Uses, Needs, and Problems





## WATER USES, NEEDS, AND PROBLEMS

Major water uses in Texas are for domestic and municipal supply, industry, and irrigated agriculture. Other beneficial uses of water include mining and secondary oil recovery, hydroelectric power generation, navigation, and recreation. Additionally, plans for comprehensive water development must consider fresh water inflows necessary for the bays and estuaries, flood and hurricane control, drainage, water quality management, fish and wildlife enhancement, intangible values derived from preservation of scenic areas and scientific values, and problems of land surface subsidence and salt water intrusion.

Intrastate supplies are not equal to these needs, either as they occur geographically, or as the needs for water increase over time. Water supply for municipal use will be an acute problem in two decades in some major Texas cities. A supply for presently existing irrigation will be needed where available water is rapidly dwindling, and fresh water inflows will be needed for the bays and estuaries. Flood and hurricane damage and poor drainage are creating severe problems now in many parts of the State.

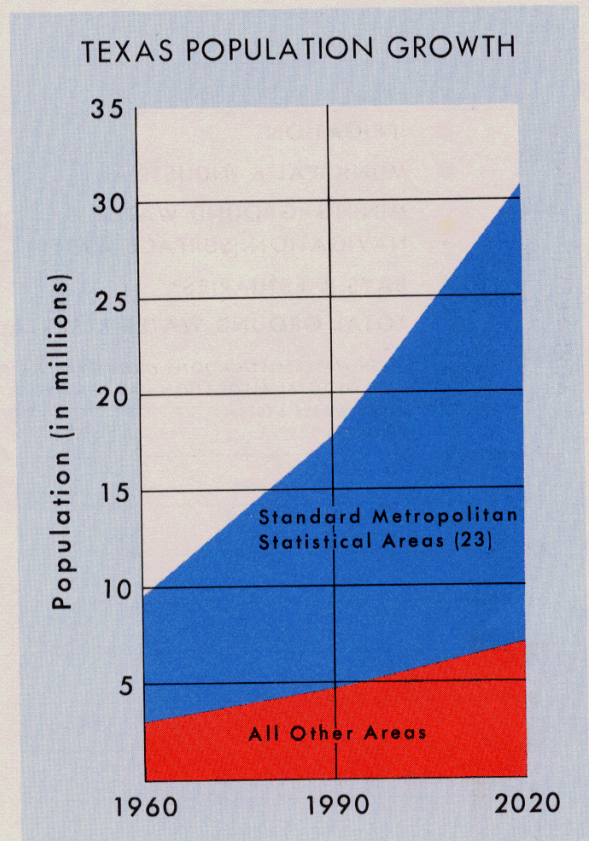
Projections of water requirements have been made by the Board for all beneficial uses. These requirements were reported in detail in the river basin summaries printed and released by the Board in 1966. These requirements will be continually reviewed and updated as a part of the continuing planning activity of the Board. The basin summaries will be revised and reprinted in 1971, using data from the 1970 census. Thereafter, updated summaries will be released every five years.

### Municipal and Industrial

Shallow wells, springs, and streams were adequate to meet man's needs for water in Texas' historical past. The systems of reservoirs and water conveyance proposed in the Plan to meet these needs for the future are simply extensions through time of the spring house or oaken bucket.

In the year 2020, more than 30,500,000 Texans are expected to use over 12 million acre-feet of water annually for municipal and industrial purposes as contrasted with the 1960 use of 2½ million acre-feet of water by a population of 9,579,677. As Texas population grows, it is also shifting from a predominantly rural

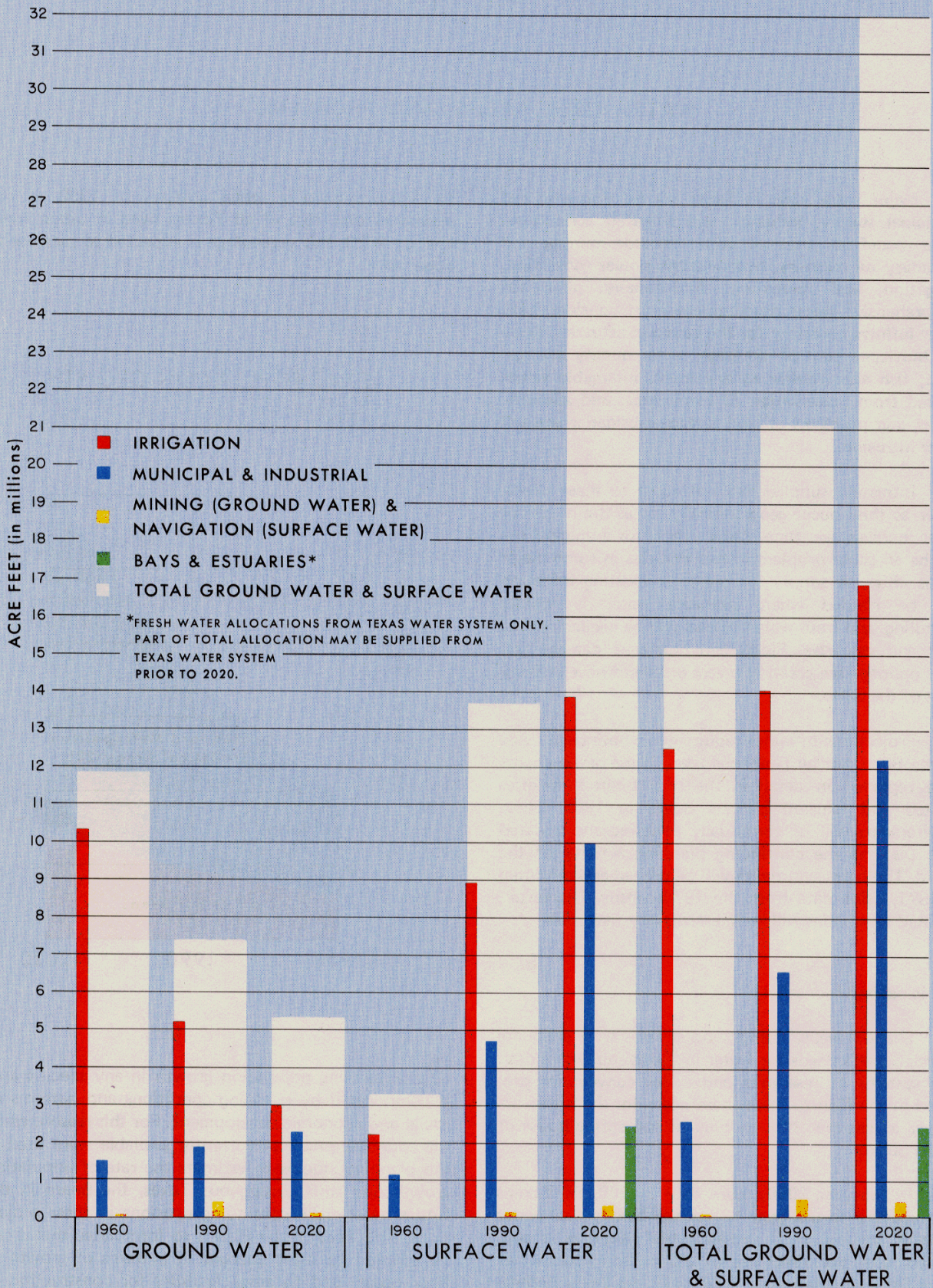
to a predominantly urban pattern. In 1960, it was estimated that 75% of all Texans lived in urban areas, and by 2020, this percentage is expected to increase to about 84%.



Projecting population growth in any specific area is complicated by changing conditions and patterns of social and economic development. For this reason, while the soundest practices currently available were used in the planning studies to estimate the rate of population growth and shift throughout Texas, the Board in the future must make continuing revisions in these projections. The Texas Water Plan is so formulated that it can be adapted to meet changes in patterns of growth as they occur, and to stage facilities for construction as they are required.

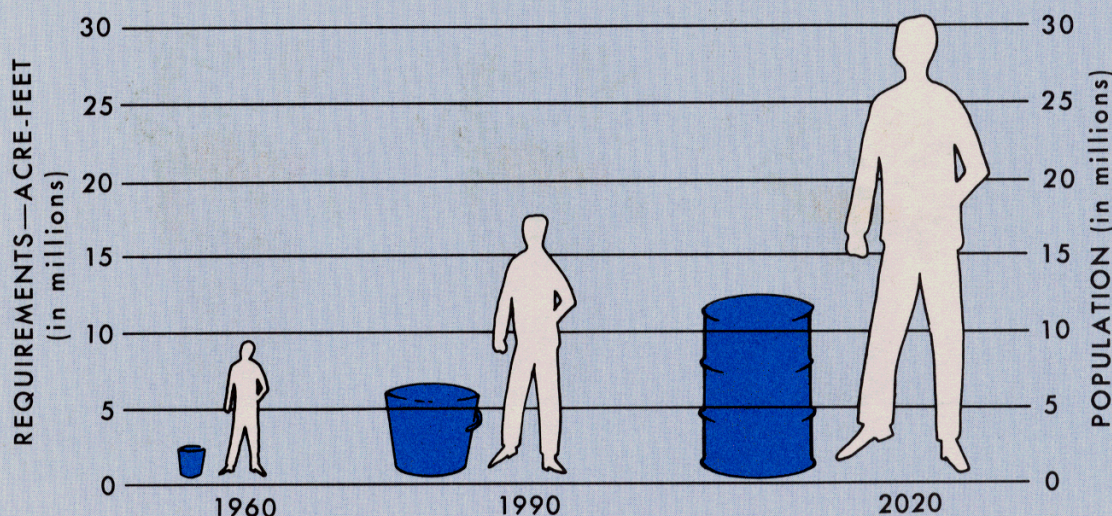


# TOTAL WATER REQUIREMENTS





## COMPARATIVE GROWTH OF TEXAS MUNICIPAL AND INDUSTRIAL WATER REQUIREMENTS AND POPULATION



This projected growth assumes that water supplies can be made available at economically supportable costs to provide for diverse municipal and industrial water demands. Present evaluations of available water supplies indicate that of the 23 Standard Metropolitan Statistical Areas (major population centers) the following will need supplemental water from the Texas Water System by 2020, most of them long before 2020: Abilene, Brownsville-Harlingen-San Benito\*, Corpus Christi, Dallas, El Paso, Fort Worth, Galveston-Texas City, Houston, Lubbock, McAllen-Pharr-Edinburg\*, Midland, Odessa, San Angelo, and San Antonio.

Proposed storage and conveyance systems in the Texas Water Plan will make it possible to provide these long-range requirements on a dependable basis. Cost of water of such quality as to be suitable for the various needs of these areas will be generally less than the costs that would be incurred by each city if it had to compete for the available resources on a piecemeal basis.

The pattern of industrial growth, and projections of the use of water by industry, cannot be predicted with absolute certainty. These projections must respond flexibly to changes in technology and industrial concentration. They must be subjected to continuing review and refinement to assure this response if industrial water supply is to be available as needed in local areas.

### Irrigation

**The present level of Texas irrigation—7.7 million acres in 1964 (and still growing)—has developed rapidly,**

**mostly since World War II. Detailed studies conducted for the Board by Texas A&M University of projected National and State food and fiber demands indicate that in 2020 these demands will fully justify the more than 9.7 million acres proposed to be irrigated under the Texas Water Plan.**

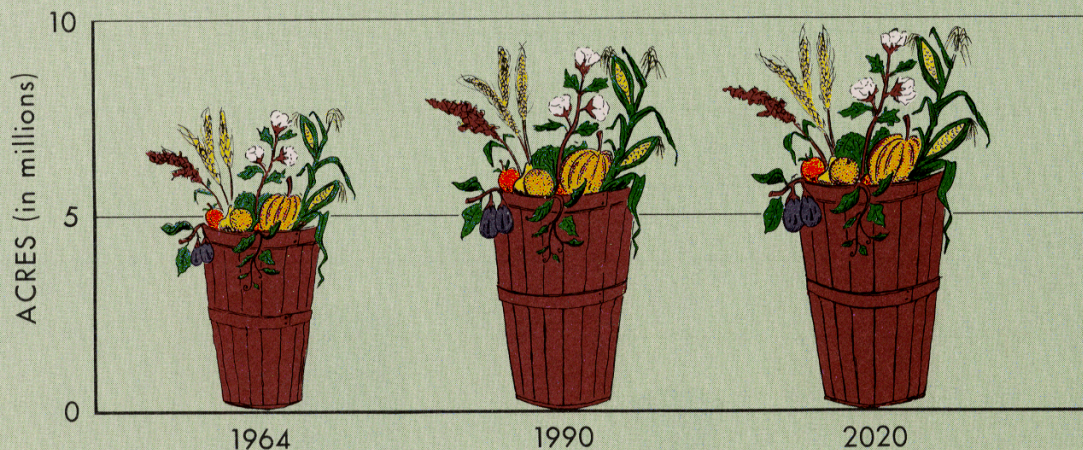
Nearly 83 percent of all present irrigation is supplied with ground water. However, many presently irrigated areas—the High Plains, Lower Rio Grande Valley, Winter Garden, Trans-Pecos, and elsewhere—face the prospect of returning to dryland farming as available water supplies are exhausted. There is not enough water in Texas available, even through redistribution, to avoid this occurring. These needs for water for irrigation in excess of available supplies do not occur in eastern and central river basins of the State where present and projected irrigation will be supplied by direct diversion or under existing water rights.

**By 1985, if a supplemental surface supply of water has not reached the High Plains, this vast area will have begun an area-wide retrogression to dryland farming which will have profound economic consequences throughout the State. The North Central Texas, Trans-Pecos, Lower Rio Grande Valley, and Winter Garden areas face equally crucial time-phasing problems. The 5.1 million acres of land irrigated in the High Plains is supplied by water from the Ogallala Formation, where water levels are declining as the result of prolonged**

\* These cities are included in the Texas Water Plan with other Lower Rio Grande Valley communities, some or all of which will need supplemental water supplies.



## TEXAS IRRIGATION PRESENT AND PROJECTED

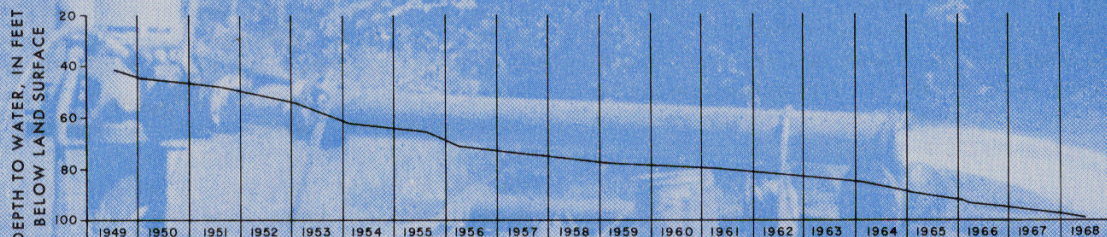


pumping at rates far exceeding the rates of replenishment. Studies by Texas A&M University indicate a potential economic demand of 6.7 million irrigated acres in the South High Plains if water can be made available at costs which would leave irrigators an economic incentive to irrigate their lands rather than dry farm. Without an import of water from outside the area, however, irrigation will have begun a severe decline by 1985, to a predicted 2.2 million acres supportable by ground water in 2020. Present irrigation of 350 thousand acres in North Central Texas will decline to about 168 thousand acres supportable by local water supplies in 2020. Planning studies by the Board indicate that only about 650 thousand acres of the 824 thousand acres historically irrigated in the Lower Rio Grande Valley can be supported by Rio Grande water, and there is an irrigation potential of 1.4 million acres in the area with an adequate water supply. An added complexity in

providing an adequate irrigation water supply in the Lower Valley area results from the as yet unresolved legal questions relating to allocation of Rio Grande water. In the Winter Garden about 200 thousand acres of the 300 thousand acres irrigated will be dry farmed or out of production by 2020 without additional water supplies, and this is an area where economic incentives are projected to create an irrigation potential of more than 900 thousand acres. Declines in irrigated acreage will occur elsewhere throughout the State without a systematic program for supplying supplemental water.

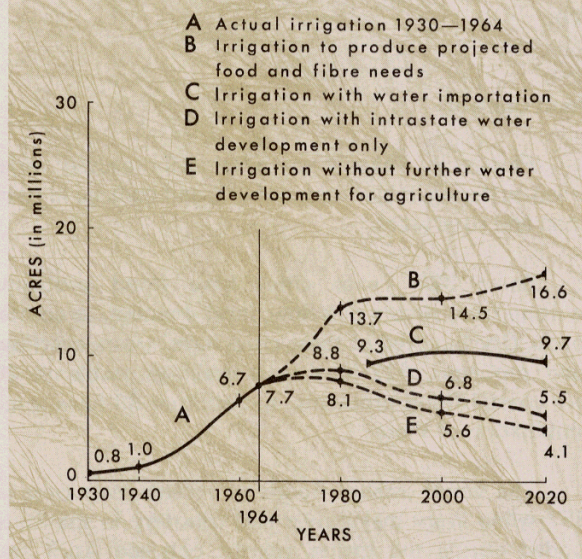
The reimbursable costs of water supply to these areas will have to be borne by the areas. The cumulative cost to the entire State of their loss as irrigation areas will be formidable if it is not possible to supplement their locally available supplies through the Texas Water Plan.

## WATER LEVEL DECLINE OGALLALA AQUIFER, HALE COUNTY





## TEXAS IRRIGATION WITH FOUR PROJECTIONS



Agriculture generates more of Texas' wealth, supporting a related annual \$6 to \$7 billion commerce and industry, than any other factor in the economy with the exception of petroleum and petro-chemicals. One yardstick of this contribution is in cash receipts from farm marketings which reached \$2.5 billion in 1964, and are expected to reach \$9.3 billion by 1990. Irrigation accounts for over half of this agricultural wealth.

The contribution of irrigated agriculture to the economy of the entire State, however, goes far beyond the direct returns for the value of crops. Utilities, gas pipelines, transportation, navigation, investments through loans and mortgages, bank deposits, canneries, food processing plants, livestock and poultry production, fertilizer and pesticide manufacturers, farm equipment manufacturers and distributors, and wholesale and retail commerce are all direct beneficiaries of a healthy and expanding irrigated economy.

### Mining

Water used in the State for mining purposes is almost entirely for the purpose of petroleum production. Sand and gravel operations and recovery of other minerals use very minor amounts of water.

Improved technology has had a tremendous impact on the oil industry through secondary recovery of oil by water injection. Fluid injection operations have increased production from 20 percent in 1953 to around 30 percent in 1965 of the total volume of oil produced within the State. Within the next 15 years up to one-half

of the oil produced in Texas will probably come from fluid injection projects.

Calculations indicate an estimated cumulative total 15 million acre-feet of water will be required in Texas through the year 2020 for secondary recovery of oil. Either brackish, saline, or fresh water can be used for injection operations, and the choice is usually dictated by the economics of water supply and operation and maintenance costs. The projection of water requirements for secondary recovery operations for this Plan was based on an evaluation of the amount of oil available which can be produced by water injection.

The largest reserves of oil in Texas susceptible to recovery by water injection are in arid areas of the State. Water to meet mining needs will be met by local surface and ground water resources as the demands on these local resources by higher priority uses are met through water of better quality imported through the Texas Water System.

### Hydroelectric Power Potential

Conventional hydroelectric power projects appear improbable in the future in Texas, although pump-back storage projects may be developed in some areas. Further planning studies may show the feasibility of such pump-back projects separate from, or coupled with, projects of the Texas Water Plan.

### Navigation

Navigation was important to the exploration, colonization, and early development in Texas. Major rivers, flowing roughly parallel courses from northwest to southeast, provided early routes from the Coast to the interior. Subsequent advances in overland transportation slowed river navigation development except in the tidewater area along the Gulf, where navigation has been steadily expanding, and contributing to the growth of that highly industrialized region.

Texas now has 12 ports for deep-draft (30-40 feet) vessels and 13 shallow draft (6-14 feet) ports. The intracoastal waterway connects the entire coastal area with a protected shallow draft route between Texas and other Gulf and south Atlantic ports. The Houston Ship Channel enables this inland area to receive and ship the third largest tonnage of all U.S. seaports.

Constant expansion of coastal facilities for domestic and overseas commerce has accelerated efforts to connect inland industrial areas with them by development of Texas rivers for navigation. Navigation on the Trinity and Red Rivers has been authorized. Proposals have been made for studies on other streams to